thor's own work. Here also is given Thomson's theory of the cause of electrolytic dissociation which while offering a simple explanation of the phenomena, has not as yet been fairly tested experimentally. The next section treats of the application of the theory to a physical problem, that of the seat of electromotive force in primary cells, and closely connected with this is a review of Ostwald's work on 'Chemische Fernewirkung.' Then follows the closing section on the application of the theory to biological problems with especial reference to the toxic action of ions.

Such is an outline of the book, whose perusal will well repay anyone who desires to become familiar with the most important phase of modern physical chemistry. It seems ungracious to offer any criticism of a book which limits itself to a definite field and so well carries out its aim, but after reaching the end of the book, one can hardly help feeling that he would like to hear the other side. The author's position is practically that of an advocate, and he makes the best of his case. It is true that he speaks of difficulties, but he does not discuss them or even allude to many of them. He says, indeed, "It has already been mentioned, and stress should be laid upon it, that there are facts to which the theory, as we now conceive it, does not seem to apply. But the evidence in favor of the theory is so overwhelming, in comparison with the few apparent exceptions, that we should examine the latter very closely before concluding finally that they are real exceptions. Without for a moment ignoring the facts for which the theory does not seem to entirely account, the writer believes that the evidence in favor of a great generalization being expressed by the theory of electrolytic dissociation is as strong as in the case of many of our so-called laws of nature. For how many of these apply under all conditions, and are entirely free from exceptions." But we wish the author had added a short chapter on these apparent exceptions, for if one reads his book to gain a knowledge of the theory, one desires to hear at least something of objections raised to it. As far as concerns aqueous solutions the theory seems to present an important and very useful generalization and yet it is not even here free from difficulties. It is also limited in its field in that it does not account for the fact of solubility, nor answer the questions why this salt is soluble, that insoluble; and in that it applies only to electrolytes. Again, as soon as we leave the field of aqueous solutions we realize that the present statement of the theory is too narrow. The work of Franklin on liquid ammonia as a solvent presents many phenomena wholly inexplicable on the theory of electrolytic dissociation, and work with other solvents raises other difficulties.

That such advances have been made along the line of this theory, as yet hardly in its teens, is a source of wonder; but much more remains to be done. The greatest proportion of this work has been confined to aqueous solutions, but it is only by extending it to all manner of solvents that any comprehensive theory of solutions will be reached. This no one realizes more than Dr. Jones, who is applying his work to the alcohols and other solvents, and the same is true of other American chemists. Perhaps after all Dr. Jones' book is the more attractive, and even more useful, because its author has posed less as judge than as advocate.

The typography of the book and its general make-up are excellent, the proof has been very carefully read. One excellent innovation has been partially adopted, that of giving the year in addition to the volume in the references to periodical literature. This, while entailing little additional work upon the author, not only lightens materially the labor of one who is looking up the original literature, but it gives the reader a much more definite chronological idea of the subject-matter. The custom should be uniformly adopted in scientific literature.

The book is provided with a satisfactory index.

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*An Introduction to Physical Chemistry.* By James Walker, D.Sc., Ph.D. London, Macmillan & Co., Limited; New York, The Macmillan Co. 1900. Pp. x + 355. Price, $2.50.

The author states in the preface that his main object in writing this new work on physical chemistry is to emphasize the important bear-

ing of the principles of the science on the ordinary work of the chemist. The subjects discussed in the book are accordingly selected with this aim in view. Thus by far the larger part of the work is devoted to the consideration of the principles of physical and chemical equilibrium and their applications, and to a discussion of the theory of electrolytic dissociation and the explanations which it offers of the physical and chemical properties of salt solutions, while scarcely ninety pages are occupied by the description of the methods of atomic and molecular weight determinations and by the treatment of the theoretical conclusions derived therefrom in regard to valence, structure, and the relation of properties to atomic weight and to constitution. This is entirely rational from the point of view of the author; for though atomic and molecular weight determinations have great significance historically and theoretically from the fact that upon them is founded the structure theory of organic chemistry, in its comprehensiveness by far the most important theory that physical science has yet developed, it is nevertheless true that this theory is now employed without much reference to the physical relations on which it was originally based, so that a knowledge of the latter is not of great value from a practical standpoint. On the other hand, the electrolytic dissociation theory and the laws relating to equilibrium and reaction-velocity find constant application to the daily work of the industrial, the analytical, and the synthetic chemist.

It is scarcely justifiable to criticise the work adversely on account of the lack of system and logical sequence which it undeniably exhibits, for it is distinctly not intended as a complete, precise, and consistent presentation of the science of general chemistry, but rather as a direct accompaniment of a concrete and highly practical character to the instruction ordinarily given in other branches of chemistry. It is a book which is especially suitable for use in connection with the brief courses on theoretical chemistry which should be given to undergraduate college students. It is also admirably adapted to the needs of the teachers of elementary chemistry and of workers in allied sciences or in industrial chemistry who desire to acquire readily a knowledge of the more concrete and practical side of the subject. It is, nevertheless, the opinion of the reviewer that every thoroughly trained chemist, whether educated at a university or technological institute, should receive a more systematic, logical, precise, and thorough course in theoretical chemistry than that which the present work is intended to give, primarily in order that he may acquire the power of close and accurate thinking, in which students of chemistry are, unfortunately, as a rule, seriously deficient and inferior to students of physics, and secondarily that he may add to his store of specific chemical information a thorough knowledge of the underlying and related general principles—a kind of knowledge which cannot fail to be of great practical value to him, whether he engages in teaching or industrial pursuits. It is, however, unfortunately true that, with the possible exception of the recent work of Nernst, which has not yet been translated and which is too difficult of comprehension except for advanced students, there is no satisfactory text-book to accompany a course of the latter character.

The manner in which the task of the author has been executed is highly satisfactory. The work is written in a readable and unwearying style. The principles are clearly stated, and are always illustrated by concrete examples. The errors to which beginners are liable are especially pointed out. The treatment is a descriptive, not a mathematical one; but the author has not hesitated to employ mathematical expressions where greater clearness is thereby attained. The author, who has supplemented his university instruction in physical chemistry by more than ten years' experience in teaching and research, shows himself throughout the book to be a thorough master of his subject, to have a sound appreciation of the relative importance of the various principles and theories, and to be entirely free from one-sidedness and the desire for radical innovations.

The work is therefore of such a character as to justify the hope that it will mark the beginning of a new epoch in the teaching of general chemistry in this country and in England.

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